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Smart Energy Grid using IOT

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Abstract: ***With increase in population and infrastructure, need for energy production is gradually increasing and to full fill the demanding needs of consumers is in organization hands. This brings the issue of energy production and energy distribution for the organization. Existing meters are not so consumer friendly and always need a periodic checking from utility to inform about their monthly tariff, which requires more man power and is a time consuming process. Also the organization is not able to maintain proper record of consumer data. This project aims to reduce this burden and it makes a real time observation of energy consumption for the consumer as well as the organization. The consumer as well as the organization is able to monitor the real time usage of energy and receive notification to their mobile or on organization website. Also, it notifies the consumer about the peak hours and the grid is able to monitor their geographical area. This project involves Node MCU as main controller and for internet communication and sending real time data over internet, current and voltage sensors.***

I. INTRODUCTION

Smart grid is an electrical grid which incorporates a spread of operations and energy measure is includingsmart meters,smart appliances, renewable energyresources, and energy efficient resources. Through technology, we are renewable to communicate between the utility and the customer and sensing along transmissions.

Smart grid will enable us to:

1) Efficient transmission of energy.
2) Quick restoration of energy after power disturbance
3) Reduced operations and management costs for utilities, lower power costs for consumers.
4) Increased in enervation of large scale renewable energy source.
5) Maintain and improve the existing services.

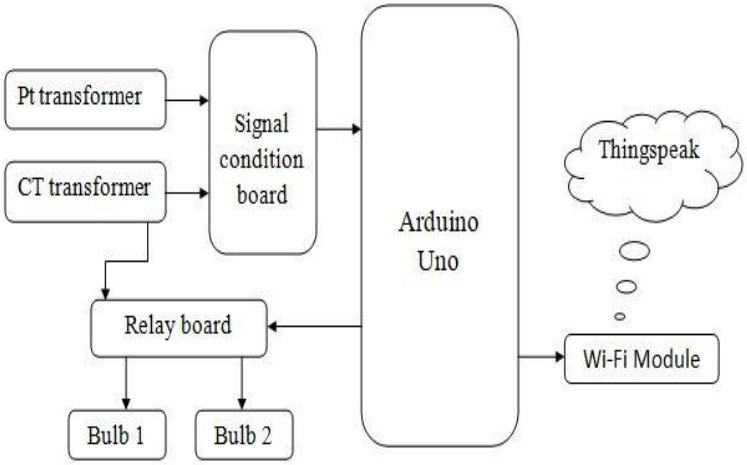
Bringing more transparency to the consumer and enable monitoring real time consumption of the energy. Handle the power outrages with the help of sensors, containing them before they become larges cal blackouts. Bring more awareness to consumers about connection between electricity use and environment. Smart grid technology also implies fundamental re-engineering of energy services although pica usage is based on the technical infrastructure.

II. LITERATURESURVEY

By 1960s, electric grids of developed countries had become highly inter connected, with thousands of central generation power stations deliver in power to major load center via high capacity power lines which were then branched and divided to power to smaller industrial and domestic users over the entire supply area. From 1970s to 1990s, with increasing demand patters, stations were notable to supply electricity especially at peak times resulting in poor power quality including blackouts, power cuts. For the developing countries the situation became worse. Towards 20th century, daily peak demands were met by 'peaking power generators' that would be turned on for short periods each day. This would result in high costs to electricity companies, which were passed on in the form of increased tariffs. Since the early 21st century, improvements in electronic communication technology to resolve the limitations have become apparent. Costs of the electrical gridis being reduced with the help of renewable energy resources such as wind power and solar power. These renewable resources are highly variable, and so the need for more sophisticated control systems became apparent, to facilitate the connection of sources Highly controllable grid.

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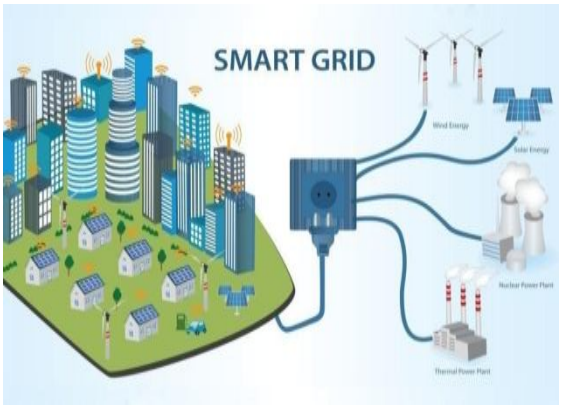
III. BLOCK DIAGRAM



IV. PROBLEMSTATEMENT

With the increasing consumer demand to meet these demands, several schemes and projects were introduced for improving the and providing assistance through various schemes for improving distribution sector. In India, projects like Integrated Power Development Scheme, Deen dayal Upadhya

Gram JyotiYojana, GramOorja were introduced in the past years and aim to provide the country's600,000villages with fulfilled electricity distribution. The government claims that18,000 villages are connected over the past three years. Distribution within the urban sector has improved providing energy to almost every household within the region and maintaining it through centralized system. But just having the connection doesn't mean everyone is getting good power distribution to their house. Only 10% of households in village must have electricity for it to be considered electrified. Rural areas in India are electrified non uniformly, with richer states being able to provide majority of villages with power while poorer states still struggling to do so. Rural electrification that aims to bring electrical power to rural and remote areas, with this aim Rural electrification corporation limited was formed to specially address the issue of providing electricity in all villages across the country. Poverty, lack of resources, lack of political will, poor planning, electricity theft are some of the major causes which have left many villages in India without electricity. Current situation and barriers that are faced by Indian Power Grid:



V. EQUIPMENT'SUSED

We have used Arduino UNO as main controller, Node MCU for communication over internet and receiving input from the consumer/organization, ACS712current sensor for analyzing current consumption, Voltage sensor for measuring voltage, Relay is used as switch for connecting the load and controlling the relay with help of the Node MCU.

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A. Node MCU

NodeMCUorNodeMCUESP8266isanopensourceLUAbasedfirmwaredeveloped for ESP8266 Wi-Fi chip. The hardware design is open for edit/ modify/build. Node MCU board consist of ESP8266 Wi-Fi enabled chip.It's a low cost Wi-Fi chip developed by Esp.resift Systems with TCP/IPprotocol.



Fig.NodeMCUESP8266wifimodule

Node MCU board is featured with wi-fi capability, analog pin, digital pin and serial communication protocols. With help if Arduino IDE, we can develop applications and send to Node MCU for performing various functions. This makes easy for Arduino developers than learning new language for the board. In the project, Node MCU will be used for sending energy related informationlike the energy consumption and the appliances connected to theconsumer/organizationandalsotakinginputsfromtheend-user.SeveralIoTplatforms allow to integrate with Node MCU and allow to communicate with the board such as Blynk ,Thing Speak. Connecting the board with the relay will allow us to control it and turn on/off the appliances accordingly.

B. ACS712 Current Sensor

ACS712isacheap,lowaccuracy,harmonicsourcecannot measure more than 10A load current. Current sensing is done in two ways – Direct sensing and Indirect sensing. In direct sensing, to detect current Ohm's law is used to measure the voltage drop occurred in wire when current flows through it. While in indirect sensing, current is measured by calculating magnetic field by applying Faraday's law or Ampere law. ACS712 used in direct mode of sensing to calculate current.

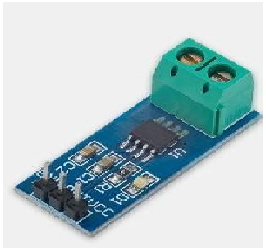


Fig.ACS712Currentsensor

Current flowing through conductor causes a voltage drop. Relation between current and voltage is given by Ohm's law. So, current sensor detects current in wire or conductor and generates signal proportional to be detected current wither in form of analog voltage or digital output.

C. Relay

Relay is used to connect appliances and equipment channel needs a 15-20mAdriver current. It can be used to control various appliances and equipment's with large current. It is equipped with high-current relays that work under ACS250V10Aor DC30V.



Fig.4-channelrelay

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High quality relay is used with single pole double throw, common terminal, a normally open terminal and closed terminal. Relay closes at low level with indicator on, released at high level with indicator off. VCC is system power source and consists of input pins to accept instructions from an external source.

VI. SOFTWARE SPECIFICATIONS

A. Arduino IDE

Arduino IDE is an open source platform used for developing code for arduino or any micro controller board. It makes it easy control, code and upload it to board. It can run on Windows, Macor Linux platform. Application is written in functions from C and C++. ArduinoIDEsuppliesasoftwarelibraryfromtheWiringproject,whichprovidesmany common input and output procedures. Link for downloading the IDE is given below: *https://www.arduino.cc/en/main/software*

B. Blynk

To interact to our controller board from our smart phone, we need an IoT platform to connect our devices. Blynk is an IoT based platform that allows to quickly build interfaces for controlling and monitoring projects from iOS and Android devices. Link to website is given below:

https://blynk.io

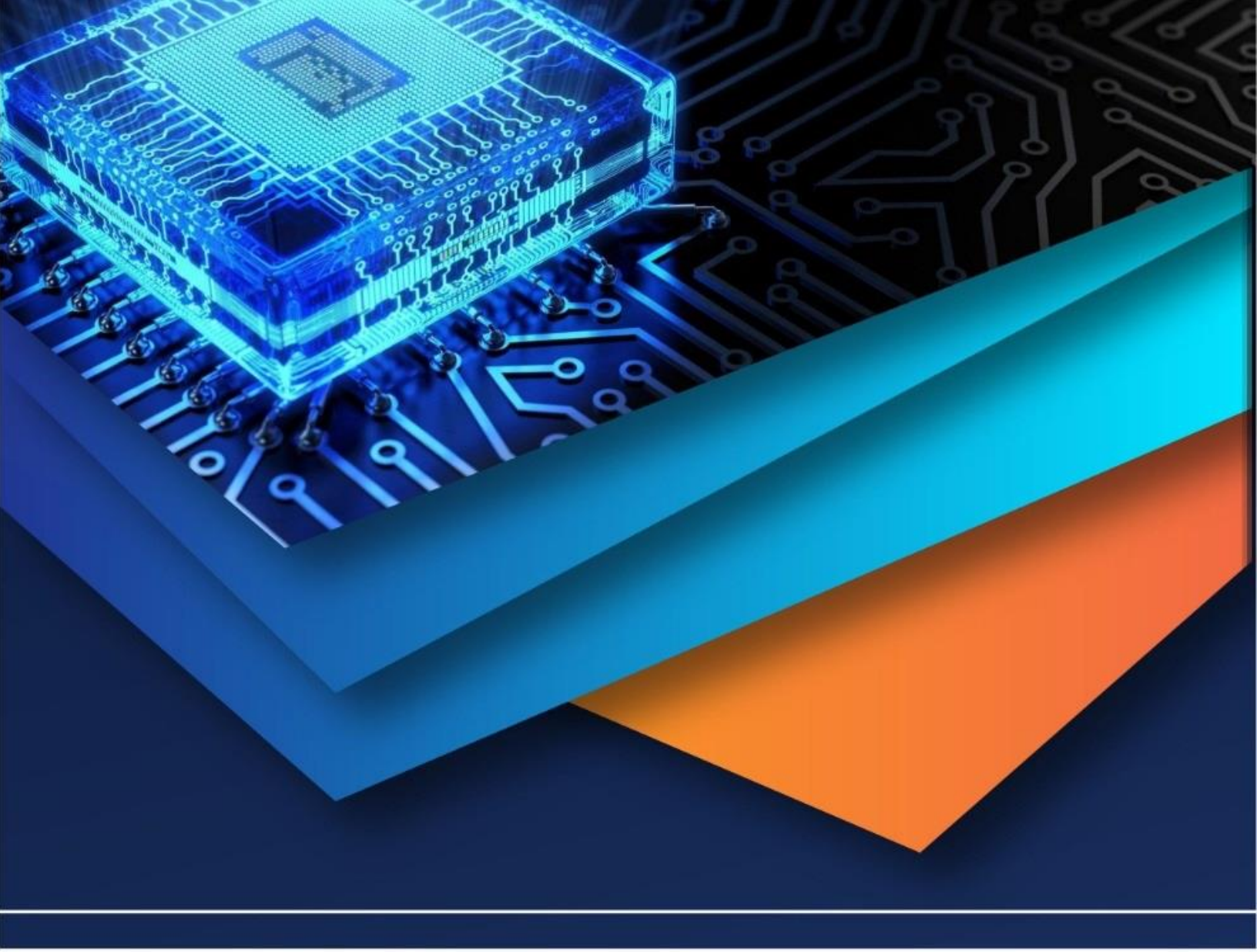
It works with Blynk server that is open source Java based server, responsible for forwarding messages between the Blynk mobile application and various micro-controller boards. Mobile application can be download from Play Store or App Store for smart phones. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other things. It has a digital dashboard where we can build a graphical interface for our project by single drag and drop and several widgets are pre sent to select accordingly to our choice.

VII. CONCLUSION

Comparative study and design of the smart grid will enable to use energy in a very efficient manner. With the help of renewable resources, peak hours can be reduced and energy distribution an also bed one to very distant areas where still people are living without lights. This will also beneficial in terms of ecological and biological manner. With use of sensors and utilizing the internet will enable to monitor and analyzing in real time and in a very efficient manner. Consumer can analyze the usage for individual appliance and use them accordingly. Notifications about the energy consumption, peak hours, blackouts etc will be send to the consumer as well as organization about the consumers information. All the information will be monitored and analyzed in real time allowing the organization to con serving and distributing the energy in an efficient manner. *Future advancement* in the model includes adding renewable resource like sola panel or turbine which produces energy and then storing it into a battery(lithium)connected. This energy will be used for future purposes like blackouts or grid failure. Excess energy produced from the houses will be sent to the respective grid that will be utilized in distribution of energy. This will be a 2 way process in which the houses will be sharing their produced energy to the grid and the grid will be distributing this energy to other grid which are handling black outs and other energy related issues. Further, advanced security measures can be taken to protect the organizations web application and mobile applications and protecting their consumers data like static ip configuration, data access control and advanced authentication mechanisms. More advanced SCADA system to monitor and analyses with data mining to efficiently record and manage the data. Securing the SCADA system with static ip configuration to make the system more secured.

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